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Losing discipline

Undisciplined research: the proceduralisation of quality control in transdisciplinary projects

Michael Guggenheim

In this paper I argue that so-called transdisciplinary research, that is problem-oriented, non-technological research outside the disciplinary structure, leads to a strengthening of organisational aspects of knowledge production and, particularly, of a change in quality standards. Quality standards are increasingly defined in intra-organisational or project-dependent and procedural instead of disciplinary terms. The paper is based on fieldwork in several environmental consulting companies that perform a broad, non-disciplinary spectrum of research and consulting. Although they perform government-funded research, neither their organisational structure nor their praxis is oriented towards disciplines. Instead their research focuses on social problems and methods that are translated into research without an intermediary disciplinary filtering. Quality has to be accomplished via non-disciplinary standards. These non-disciplinary standards are all procedural: namely quality management, timesheets and accompanying supervisory groups.

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TRANSDISCIPLINARITY is often hailed as a new way of knowledge production, replacing the old, narrow, disciplinary boundaries of knowledge production with a new type that is supposedly closer to societal needs. Such definitions of transdisciplinarity obviously rest on certain assumptions about disciplinary knowledge production. Disciplines, in this view, are seen as restraining mechanisms whose specific theories, instruments and methods constrain what can be known.

According to this view, disciplines do not allow the creation of new research questions but restrict the different ways of knowledge production and subject them to a disciplining logic. Disciplinary science is described as remote from societal needs, because it splits dense problems into disciplinary chunks, each missing the problem as a whole. Disciplines are thus seen as a device that prevents grasping the 'whole' problem. Transdisciplinarity in contrast is seen as a way to overcome the narrowness of disciplines, to circumscribe a problem in its real form and to address it without disciplinary restrictions.

However, as I seek to show in this article, if transdisciplinarity is not just freestyle knowledge production out of the blue, similar to a private language, it is also dependent on constraining factors. No research project has endless resources and endless intellectual capacities. There are no theories of everything and no catch-all methods. Thus, even in a transdisciplinary research project, time and money are limited, some methods have to be applied and others not, some details have to be left out and some issues can be touched on only in very approximate ways. And in the end, somehow the results have to be assessed.

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In this article I focus on the last issue. The assessment of results in disciplinary research depends on disciplinary peer review. The assessments of results demands that the assessor is knowledgeable about the field of research, which is what the disciplinary organisation of science provides for. Since such disciplinary peers are not available in transdisciplinary research, other, non-scientific mechanisms are employed. By 'non-scientific' I do not imply that transdisciplinarity is bad science; rather, that the control of quality is shifted in transdisciplinarity research to agents and mechanisms outside scientific organisations. Also, since these agents cannot judge results, quality control is shifted to other parts of research, namely organisational and procedural issues. In the absence of sound judgments of results procedural measures become indicators of quality.

The test case for this argument is provided by environmental consultancies. These firms pursue environmental research independent of disciplines and close to their clients; they provide thus an ideal-typical case of transdisciplinary research.

I will first introduce the theoretical problem in greater detail, putting emphasis on the question as to why transdisciplinarity is thought of as different from disciplinary science. Second, I will briefly introduce the field of environmental consultants. The main part of the article discusses three different ways of quality assessment in environmental consultancies and how this affects knowledge production. These are: quality management systems, timesheets and advisory boards. All three mechanisms lead to a *proceduralisation* of quality control, which is linked to its position outside disciplinary science.

Differences in quality control

Disciplinary knowledge production works under the assumption of the autonomy of science.[1] By this I do not imply that disciplinary science is completely independent of the rest of society, nor that there are no connections between research themes and societal problems. But disciplinary science knows a specific routine to create autonomy. It is disciplinary peers, and not outsiders, who judge disciplinary knowledge production. The peers decide about funding, publishing and evaluating research and researchers. The quality of work is judged through a grant-application process and a peer-review process of books and articles.[2] It is other *scientists* who set the standards for a discipline.

Disciplines are furthermore international in scope, and open for everyone who is considered to belong to a certain discipline. 'Membership' is acquired through training and labeling and thus open to contest, unlike in organisations, where it is unambiguous. The autonomy of the scientific disciplines also leads to the often-despised disciplinary boundaries and narrow-mindedness.[3] The autonomy of science is the autonomy of scientific disciplines.

Interdisciplinarity transcends these constraints, through fusion or collaboration between different disciplines. As Peter Weingart has argued, interdisciplinarity is an early stage in the life of a new discipline (Weingart, 1987). Interdisciplinarity is only an in-between stage where disciplinary constraints are unclear or confused. Once the new discipline has been formed, it resembles the existing ones, and loses its interdisciplinary character. It develops its own associations, canon, introductory books, autonomy and boundaries.

Transdisciplinarity, as I understand it here, expands the notion of interdisciplinarity by introducing actors outside of science as an integral part of knowledge production (Gibbons *et al*, 1994: 167f; Klein *et al*, 2001: 4; Pohl, 2001).[4] The difference between disciplinary and transdisciplinary science is not the relevance of research results nor their applicability. The difference is that it is not only scientists who define research questions, theories and methods but also lay people, or other stakeholders, to use a popular word in these circles, who introduce *other* criteria for choosing methods and theories.

Transdisciplinarity, like interdisciplinarity, is only possible after the system of disciplines has been put in place. There may always have been research that fits the above criteria for transdisciplinarity. But as long as there were no disciplinary border controls, there could be no urge to transcend these borders.[5] Transdisciplinarity is a break with the view of autonomous science. The main reason for this break is the insight that science is said to have become too autonomous, meaningless or out of touch with societal problems. The integration of actors outside of science leads to different ways of discussing and evaluating scientific work, since scientific issues are by definition out of place. Obviously, persons working outside scientific organisations may contribute to research without changing any scientific criteria, but such research is not transdisciplinarity, it is just research done by non-university people.

Transdisciplinarity is also different from applied science and technology or the work of professions. It is different from technology, because transdisciplinary knowledge is not testable by whether it works; it cannot be patented. Transdisciplinary knowledge is knowledge that relates to the world as disciplinary knowledge does: it adds different descriptions, which enable different actions. Transdisciplinarity is also different from the work of professions, such as medicine or law. The work of professions is defined through complex problems, which are not solved by inventing new technologies, but with case-specific treatment (Abbott, 1988: 8). Professions are defined through a relatively clear-cut distinction between themselves and a university-based discipline. The discipline creates the space in which the autonomy of professions, that is, their independence from being overtaken by practical problems, is secured (Stichweh, 1994). Transdisciplinarity is similar to professional work because it is

case-specific, but it lacks a direct link to a single academic discipline. Transdisciplinarity is thus a way of producing knowledge, which can neither be fully controlled by disciplinary standards nor by a test of its functionality.

The question then is: how is transdisciplinary work carried out and how is its quality assessed, if there is neither a test of its functioning nor a separation between a profession and a scientific branch? I want to show in this paper that the switch to non-scientific mechanisms that ensure transdisciplinary knowledge production involves a switch to *procedural mechanisms*. Procedural mechanisms emerge because of a lack of an external common vantage point for the judgment of research that is usually provided by a discipline. There is neither a disciplinary truth to refer to, nor a common habitus that would coordinate the judgments.

Furthermore, because transdisciplinary research is usually not replicable due to its local and time-bound character, the *process* of transdisciplinary research itself becomes the object of evaluation. And because the process is not controlled by a discipline, the features to control are *formal* instead of content-bound. The practices of work become the focus of quality control, not the results. The switch to procedural mechanisms such as quality management systems, timesheets and supervisory groups described below is not simply an outcome of an economisation of science and the introduction of organisational methods that are foreign to research. The procedural mechanisms are the result of the transdisciplinary character of this type of research. They take the seat that peer review occupied in disciplinary research.

This is a stark contrast to the output-oriented mechanisms of only peer-review-based science. The procedural character of these mechanisms has important consequences for how transdisciplinary research is done and for how we conceive the production of knowledge.

Environmental consultancies

The empirical material in this article is taken from fieldwork on environmental consultancies in Switzerland.[6] The material is based on interviews with representatives of 20 different companies and on extended fieldwork in four different companies. The presentation here focuses not on differences between the companies, but on their commonalities and what separates them from disciplinary science.[7]

Environmental consultancies are private companies that perform research on environmental issues.[8] Environmental consultancies provide interesting material for an analysis of transdisciplinarity because they can perform much more 'pure' transdisciplinary work than universities since they do not suffer from the organisational restrictions of disciplinary university science. Environmental consultancies operate on the borderline of research and consulting, being political pressure groups and independent experts all at the same time. They thus provide an often overlooked but almost ideal typical case for transdisciplinarity.

Environmental consultancies are historically a direct reaction to the perceived narrowness of disciplinary knowledge production. They emerged from the 1970s onwards together with the new environmental discourse reacting to the overt reluctance of academic science in Switzerland to confront environmental issues.[9] From the viewpoint of the founders of the consultancies, academic science was overly scientistic, not political enough and shying away from solving the huge problems of pollution and environmental degradation. Thus some natural scientists founded companies and started research projects on environmental issues. They sold their expertise to companies or government agencies, and were funded by traditional scientific grant agencies too, such as the Swiss National Science Foundation (SNF). Today, they exist besides different environmental disciplines. They perceive the universities partly as competitors, partly as collaborators. The companies employ staff from a wide range of disciplines. The organisational structure of most of the larger companies is of a matrix type.[10] They are divided into thematic departments (such as water, energy or economy). Projects in turn bring members of different departments together.

There are two reasons for the preference for a matrix structure. First of all, the structure of consultancies does not have to be disciplinary, since they are only consumers of disciplinary-trained persons but do not sell them back to the academic job market.[11] Second, a matrix structure allows quick reactions to changing societal demands. The matrix structure makes it easy to assemble different teams for new problems (Hobday, 2000).[12]

Environmental consultancies are working outside the disciplinary fields because organisationally they are not part of the university system. This becomes visible also in other areas such as quality control, the theme of this article. Although many projects of these companies could equally be based in universities there are some differences as to how projects are accomplished. Most notably, the results are rarely

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published in traditional scientific journals. This is not because the articles would be refused, but because the companies lack time and money to write the articles, because publications are not part of the tender and because the companies gain their reputation by other means.[13] Because of this, disputes about (extended) peer review, such as those described in the article of Michael Pregernig in this issue (pp. 445–455), are rare. Most of the issues surrounding quality control happen on levels directly related to the organisation of projects.

There are three other types of quality control applied in the companies, all of them differing from disciplinary quality control: quality management systems, timesheets and supervisory boards. Obviously these three types are not unique to environmental consultancies. They exist in other consulting or knowledge-intensive businesses as well and they are well on their way to universities.[14] All three mechanisms are not merely incremental as in university-based science: in the absence of peer-review processes they provide the sole basis for publicly demonstrating the quality of work.

Furthermore, quality management systems and timesheets are tied to the organisations; they do not exist in all of the environmental consultancies; they are a result of the growth of the companies. We do not find them in very small companies with fewer than 10 employees. They are a reaction to organisational complexity. Only supervisory boards are related to the type of projects, and not to the organisations.

I do not argue here that these mechanisms are specific to these companies. Each of the three mechanisms may be found in university departments, in private research organisations or in state-funded extra-university research organisations (see Lengwiler, this issue of *Science and Public Policy*, pp. 423–434). But I maintain that they are a side effect of transdisciplinarity, because they all compensate for disciplinary control mechanisms and together form an ideal type of process-based quality control instead of result-based peer review. The environmental consultancies are ideal types because they combine different criteria which all make the influence of the described mechanisms more likely. They operate outside the disciplinary system; they do not form a profession in the strict sense; they do not produce patentable technologies; they involve other stakeholders in the research process; their fields of work are highly politicised and open to public contest; and they are for-profit organisations.

None of these criteria is specific to environmental consultancies but they add up to a case that demonstrates the proceduralisation of evaluation of research results in one of its purest forms. It is important to note that although we deal here with an extreme case, this is still about organised and systematic production of new knowledge, and not simply about consulting in the sense of applying old knowledge to new cases. The projects of these firms are similar to those of the university-based transdisciplinary researchers described in the article by Maasen and Lieven (this issue of *Science and Public Policy*, pp. 399–410). Environmental consultancies are different *types* of organisations from universities, but because of this, they do not a priori produce different *kinds* of research.

Quality management

Some of the companies introduced so-called quality management systems (ISO 9000; abbreviated to QMS hereafter).[15] QMS are first of all self-descriptions of the companies, detailing products, means of production and clients. Furthermore they contain a normative evocation of the culture of the company, stating how the company wants to work, how it wants to deal with clients, etc. As such, QMS are not explicitly connected to knowledge production. Although a QMS could simply be seen as an inappropriate economic instrument to control research this would miss its meaning and effects. Because a QMS is nothing but a prescriptive manual that can be applied to *any* organisation it is equally applicable to research. It is not specific to science and thus operates on an procedural level. A QMS adds a frame to research practices, which operate on at least four levels that differ from disciplinary framings.

First of all, QMS operate on the level of the *whole company*. Even if it describes knowledge production itself, it describes it as knowledge production of a certain company. A QMS aims at singling out a certain company *vis-à-vis* other companies, not *vis-à-vis* other ways of knowledge production in the disciplinary sense. Furthermore it aims at a *positive* description of its subject. Other than disciplinary knowledge production it does not relate the work of a company to any standard outside of the company. A QMS relates the work only to the standard defined by the company itself. The ISO guidelines set criteria and dimensions to be measured, but they do not specify a standard for these dimensions. A QMS therefore implies a shift from standards defined by a community of people who work on the same subject (members of a discipline) to an organisation that is in itself heterogeneous with regard to the contents of the work. A QMS is and cannot be specific to, for example, the questions of river renaturation; rather, it has to encompass all projects of a company.

Second, in interviews, company representatives often explained that the introduction of a QMS did not change the company. Rather QMS, in the opinion of the company members, are ways of *formalising* already implicit rules. One founder put it like this:

> I do not think that much has changed [since the introduction of the QMS] or that things work better now. Actually not at all, maybe

> marginally. Because many of the issues in the QMS were in use before. And other issues are in the QMS, but are ignored in fact.

The effect of a QMS is not changing the company or in a strong sense controlling its functioning. Its main function is to make visible and formalise what is happening anyway, and to disregard it, if necessary. In this respect, its function is similar to the copy of Lakatos' *The Methodology of Scientific Research Programmes* on the bookshelf of a lab scientist.

Third, the main benefit of the QMS is seen in the PR effect it has for a company.

> We had to create a difference against our competitors. [The clients] take the cheapest offer among those who deliver acceptable quality. Hence we got an ISO 9001 certificate, so that we could tell every client: "Look, this is the proof for the quality of our work,"

one interviewee said. A QMS is primarily a public statement that the company has everything under control. As a PR effect it works only where it is not yet a standard. It is used to distinguish one's own company from others. But it does so not through specific qualities, but through its very existence. As a PR effect, a QMS is relevant only as long as not every company has one; and the more companies that have one, the higher the pressure on other companies and the less the relative advantage for those who do have one. The introduction of QMS is therefore part of a formal standardisation or, in the language of neo-institutionalism, of isomorphism of companies (Mendel, 2002).

But paradoxically, and this is the fourth point, the QMS in its details is *secret*. What is accessible to the public is only the *existence* of the QMS, not its contents. A QMS only tells the public that *something* is done about quality and that it is supervised by international standards; not *what* is done. In those two companies with a QMS where I did fieldwork, I was first of all warned that the QMS is a business secret and that I would be allowed to see it, but not to quote from it.[16] The reason for the secrecy is the idea that a QMS describes the comparative advantage of a certain company and to know about this advantage would allow competitors to imitate the successful company. The QMS in these companies then served to define the company and to stabilise this definition inside the company.

For knowledge production, the effects of the secrecy of the contents are remarkable. The QMS, which is a formalisation of the companies' ideologies, is considered a secret, whereas the actual work is not. Every customer, every collaborator and myself, the ethnographer, get detailed insight into the actual working of the companies. All these people see how projects are planned, how efficient, accurate and imaginative projects are handled and how the teams work together. The actual practice is not and cannot be kept secret. This is quite unlike the workings of scientific laboratories where, if at all, the actual practice is kept secret, whereas self-written prescriptions of one's work are open to the public. In university-based science, everybody knows the ingredients to do science; relative advantage is seen in the speed and originality for new ideas and fields. In environmental consultancies, the QMS is kept secret, because the companies believe some *organisational procedures* exist, which distinguish them from their competitors. It is the procedures, so they think, that make a difference, not the results.

All these four features of a QMS refer, as the word QMS indicates, to the management of quality, but they differ from disciplinary control mechanisms. They concern a whole company and not only thematic groups; although they are prescriptive they are mostly directed at the outside of the company and they are kept secret.

Money is time

Timesheets are a second way of conducting quality control. Timesheets are software to calculate work-hours and costs per project. The measurement of products by their efficiency is typical for industrial capitalism. It is an old technique, but usually related to processes deemed to be economic. For science such a measurement seems inadequate, even in big science. Scientific papers or projects are not judged by the amount of time involved to produce them. Scientific organisations press their researchers to produce something, but this stands in no relationship with specified results. Whether it took someone a year or three to conduct his or her research project does not matter for its judgment. This is very much tied to how the self-image of science corresponds to its way of payment. Scientists at universities are paid a monthly salary, which is only loosely related to their duties and output. Science is supposed to be a calling, a vocation, separating the work (not the results) from bureaucratic interference. On the downside the loose relationship between payment and output makes scientific work stressful, making people work a lot for little money.

In environmental consultancies a project is not only defined through a certain task definition, but also through a price tag coming along with this task. A project is paid (as in science) as a total sum defined in advance, based on an estimate of the amount of work. The employment structure reflects a different relationship to the vocation of the employees. People are employed on the basis of a monthly salary and, different from university-based science, a monthly amount of time to work for that salary. Employees are not assigned to single projects, but work in multiple parallel projects.

A project then is not only defined through its goals, but also through the amount of work-hours estimated to complete the project. The overall

revenues of the projects have to bring enough money to a single company to pay all the salaries. For each company it is thus of utmost importance to control the amount of work allotted for each project, and furthermore the amount devoted by each person per month and per project. The employees are paid for their effective working hours, and if they work overtime, this is charged to the company or compensated with holidays. If a project takes more time than estimated, then money has to be taken away from other projects.[17]

The task of mediating the general revenue of a firm, its projects and individual work hours is accomplished with timesheet software that allows complex calculations of productivity per project, person or the whole firm.[18] The main effect but also a precondition of these timesheet systems is a decoupling of researcher, project, and object of research. Each of the three is seen from the viewpoint of the company as a whole and each is an interchangeable variable.

So, an important part of every project is the monitoring of the timesheets. Every project meeting includes a section where everyone looks at the timesheets and explains how much time he or she has used for which task and how many hours are left for the tasks still to do. Usually a bargaining between the different project members follows, because the numbers are not in line with the plans. Then, in most cases, the hours and tasks are fitted to the project, and not the project to the people. Thus, hours and tasks are constantly swapped from one person to another in order to conform to the needs of the project.

There are several notable effects of this practice for knowledge production. Timesheets facilitate a strict decoupling of the object from the researcher. In large companies without such technical helps it would be impossible to determine whether an employee has the knowledge and free time to help out in a troubled project. This differs from university-based science, where persons are usually tied to their research objects, even to the degree that the objects dictate the schedule of the individuals (Knorr Cetina, 1999: 171ff, 216 ff).

Second, the constant monitoring and the tight time corset lead to an imbalance between past and future, between already accomplished work and tasks still to be done. The further a project proceeds, the less time is available, irrespective of the importance of certain tasks, which leads to the following kind of dialogue:

> Gerda: I've got the numbers here. We've used two thirds already. There isn't much left, and I don't know what we've done already. It would be important to know how much we already did, and how much is left to be done.
>
> Grazia: Well, there is quite a lot already done, it's only a question of form. But there is some.

In the dialogue we can see how money and time are made visible as numbers, whereas work is not. To know how much has been accomplished is a difficult matter, because it is a question of "form", not of numbers. Transdisciplinary project work is difficult to visualise, there is nothing to count. The calculating force of timesheets with respect to time and money and their weakness for calculating work create the difference between what can be evaluated and what cannot. This is a common feature of projects, but it is worsened, because the timesheets set a strict frame with financial consequences for the whole firm.

Hierarchy also becomes an important issue in the accomplishment of projects. Older and more experienced employees earn more and charge more for their services, which is also reflected in the timesheets. The more senior employees work in a project, the fewer hours there are. Thus a project always has to reach a balance between younger and cheaper project members and more experienced but also expensive project members. Older, more expensive employees are likely to be overrepresented in projects, because they are more experienced and broader in scope. Thus a delicate balancing between the financial interests of using younger and the project-inherent ones of using older employees is needed.

Complications arise if the quality of presumed tasks and the seniority of the researchers diverge. For example, when a junior employee had to attend a course in rhetoric, her project partner, a senior employee, should have taken over her work for two days. "That's going to be expensive, especially if I'll have to work as a secretary," he commented. Again, this is a general feature of hierarchically organised work, but again, timesheets make its effects visible in all its details and bring it to the attention of every employee. Everybody is constantly aware of the costs of his or her activities and is constantly occupied whether the activities are suited to his or her position and the project budgets.

On the level of the whole company the following dynamics must be tackled. The more senior, long-term employees a company has, the higher the salaries and the likelier the introduction of ever more

The main effect but also a precondition of timesheet systems is a decoupling of researcher, project, and object of research. Each is an interchangeable variable, seen from the viewpoint of the company as a whole

hierarchy levels. Higher salaries increase the costs of projects.[19] Because it is unlikely to raise the costs per project, the companies tend not to keep too many senior researchers, but rather have a 'roll', as one interviewee said, of junior employees who leave the company after a few years, because they do not find an opportunity for promotion.

The problem of expensive senior researchers is opposed by another dynamic. Senior researchers attract work, because they are more experienced and broader in scope. Junior employees tend to be underworked, because they cannot be used in every project. The strategy of employment is thus to hire all-rounders to overcome uneven workloads.[20] Again, timesheets do not create the problem, but make it visible, because they allow people to see the detailed monthly or yearly workload of each employee. Timesheets thus shift the attention from the optimal, specialised solution of projects to the optimal distribution of workloads irrespective of the needs of the projects. They prefer organisational and procedural measures to result-oriented measures. Timesheets shift the importance from qualifications of individuals to the financial stability of the company. On timesheets you cannot see whether somebody was qualified to do his job, but you can see whether he did work at all.

To summarise, timesheets allow for a very complex interdependence of projects and people, with the consequence of making the organisational aspects relatively important and questions of specialisation relatively unimportant. The timesheets allow and force to judge the quality of work *per time* and do this in *real time* during the accomplishment of a project, thus inserting mechanisms of control and flexibilisation at the same time. Timesheets shift the focus from the end-result to the accomplishment of a project, which is further abetted by the closeness to other, also strict, timescales of the projects. Transdisciplinarity as closeness to social problems is expressed in the closeness to the timescales not only of the problems themselves, but also to the timescales of clients. Timesheets are technologies to balance and adjust the different timescales of the clients, the problem and the project. For environmental consultancies, it is at least as important to have some results in good time rather than good results later.

Supervisory boards can be seen as signs of a lack of autonomy for consultancies. They could also be seen as a strategy to avoid further problems after completing a project

Supervisory boards

The last aspect of quality control I want to discuss here is the monitoring of projects through supervisory boards. Supervisory boards monitor most projects of environmental consultancies. The boards consist of delegates from the clients and university professors and sometimes representatives of target groups. Supervisory boards are quite different from university-based research. They do not evaluate the end-result, but monitor a project in the making. The monitoring is handed over to a group that is neither part of the organisation nor can its members be considered as equal 'peers'. Rather, the supervisory boards consist of people who are *different* from those carrying out the project. They are all unequals. Thus supervisory boards show quite precisely the location of companies. Organisationally the companies do not really belong to science, because they have to be monitored by 'real' scientists, professors from universities.[21]

Furthermore, the consultancies are not fully-fledged professions, since professions control the assessment of their work and attempt to lock out other actors from supervising their work (Abbott, 1988). Supervisory boards can thus be seen as signs of a lack of autonomy on the part of consultancies. However, they could also be seen as a strategy to avoid further problems after completing a project, which is also the view of the consultancies themselves. Instead of just doing a project and handing the results over to the clients, the supervisory boards permit changes to and correction of the project in its gestation. The autonomy of projects is not even attempted.

Closeness to supervisory boards makes it difficult to follow the logic of the objects. A tender usually lists the products of a project, and when and in which form they will be delivered. The products are listed in great detail in order to minimise sources of conflict between client and company. For the companies it is quite important to keep these promises, because their reputation mainly rests on the correct delivery of the products.[22] Changes to a project are therefore immediately reported to the supervisory board and, even if the projects take other directions than planned, the companies tend to stick to the original plans. Often, for example, there is a need for — politically useful — numbers, no matter what the project is able to deliver.

In a project on river renaturation a number of measures were planned to decrease the likelihood of floods. After very long calculations the results showed that the measures only marginally minimised the risk of floods. "The client needs numbers and now he has got them, even when the results show that the measures we propose do little to help," one project member commented.

The clients and the supervisory boards can also be used to legitimate a road once taken in case of conflicts inside the company:

> We shouldn't change the objects of research, once we have defined them. We have chosen a method, so let's stick to it. Moreover, we communicated the method to the clients. If the clients want us to do something else, we can still be responsive to it.

It is exactly *because* the plans are communicated to the clients that they have to be followed. The communication with the supervisory board becomes a reason in itself. A project of a company was close to total failure, for reasons due to problems with collaborators. When a report to the supervisory board was due, the company did not know how to proceed and did not have any meaningful results at hand. A discussion arose on whether or not to inform the supervisory body at this stage. A project member declined the proposition with the following argument: "I want to be on good terms with the supervisory board and thus it cannot be a strategy not to report. This is not professional. Something has to be reported."

Reporting to the supervisory body has the function not only of securing scientific quality; it is as least as much a function to *show* that the company is working at all, and that it is working in the sense of the tender. It is not like in university-based science, where the time structure of communication follows the logic of objects, where at the point when results are found they are brought to the scientific community.[23]

The dynamics of communication lead to a constant monitoring of when to communicate what to the supervisory board. In one of the companies, the terms "to manage the clients" and "taking care of clients" were used for this activity. For a difficult client even the term "nursing role" was used. A project is thus not only an organisational form to produce results, but a relationship with a supervisory board in which every step has to be reported.

However, there is still a need for autonomy, in the classical sense of trying to do what one thinks is best for the project. Thus there are strategies to shield the project against the influence of the supervisory board. First of all, these are strategies of positioning oneself with respect to the supervisory board.

The relationship to the supervisory boards is defined through the unequal relationship to the different members of the supervisory boards. In cases of conflict, the *difference* is employed to legitimate one's activities. University professors are defined as narrowly scientistic, whereas the consultants view themselves as more 'practically' oriented, achieving a compromise with the other stakeholders and thus not stubbornly following theoretical and methodological routines.[24] At the same time these arguments re-enact the position of the consultants as at the margins of or outside science.

Towards the clients, however, the situation is exactly reversed. Although the clients are often represented by administrators with university degrees or even a PhD in similar fields as the consultants, clients are treated as non-scientific and therefore without a say in scientific matters. In cases of conflict, the consultants often try to delegitimate the clients' standing as scientifically knowledgeable, as for example in the following passage in a meeting, where the consultants talk about their client:

> Lars: It's the first time I've made such a detailed concept. We can't do it even more detailed or it will be impossible to handle the questionnaire. My question is: how serious are they [the client] about this?
>
> Hans: [The client] has no idea of methods, and confuses methodological questions with other legitimate points of critique.
>
> Lars: But why can't the client just lean back and say: "There are three professors (in the supervisory board) who have everything under control?"

Hans then goes on to explain that the client cannot lean back because she has training in biology and wants to show how knowledgeable she is. He attributes to her an urge to be involved in methodological questions without knowing enough about the science in question.

It is important to note, as can be seen in the example above, that conflicts between consultants and clients are not solved with reference to *disciplinary* standards but with reference to science *per se*. Supervisory boards operate outside of disciplinary frameworks and thus have to discuss differences with a *general* reference to science.

In supervisory boards the difference between university-based scientists, consultants and clients is reinforced and places the consultants in between the other two. The supervisory board puts the project-in-the-making under constant review, which helps to fit the project to the wishes of the clients and at the same time to keep to scientific standards.

Conclusion

The procedural character of these three mechanisms has important consequences for the way companies work but also for the way we conceive the production of knowledge.

The three mechanisms move the control of quality from the results to the processes. They all sum up to a constant monitoring of work in terms of:

1. self-defined standards (QMS);
2. the consumption of time and allocation of time and money to projects and employees (timesheets); and
3. the wishes of the clients and other scientists (supervisory boards).

Taken together this particular kind of transdisciplinarity is not just knowledge production that is closer to society, whatever that might mean, but a new way of producing knowledge that replaces results with processes and thus makes knowledge production relational to its circumstances of production. It is not judged in relation to disciplinary standards but in relation to very specific demands related to the projects and the organisation. The loss of disciplinary control does not simply indicate a politicisation of research. It is as much related to mechanisms related to the organisations themselves.

In environmental consultancies, organisational and procedural mechanisms substitute partly for disciplinary ones. These mechanisms are different from scientific ones because they are *universal* and *independent* from disciplines. They do not rely on specific methods or theories but can be applied to any project. Any project of a company can be measured by the same standards. The proceduralisation of quality control assumes that the workflow of a project is critical for the delivery of good results, more than content-specific theories and methods. In this respect the mechanisms are more universal than those of disciplinary science.

At the same time these mechanisms are highly specific to the organisation. They do not provide a measure to compare projects of one company with those of another. All the mechanisms described in this paper are restricted to the organisations or single projects. They do not guarantee that the results of a project are true, correct or useful in any other context. In contrast, the Mertonian norm of universality of science relates to the validity of results outside of their context. Science is universal because it extends its findings beyond its immediate context of production. Universality is dependent on networks as actor-network theory has shown (Latour, 1993). Peer review is part of these networks; the procedural mechanisms are not, since they provide the networks for local functioning only.

Notes

1. The autonomy of science has been one of the central themes of the sociology of science, from Max Weber (1988) and Robert King Merton (1973) to Pierre Bourdieu (1975).
2. A recent review on peer review as a practice can be found in Hirschauer (2004).
3. Andrew Abbott observed "the nearly constant content of the 'disciplines' literature, which has been decrying narrow disciplines, urging interdisciplinarity, and foreseeing blurring of genres since the 1920s at least" (Abbott, 2001: 122, note 1). The emergence of disciplines and the call for interdisciplinarity are historically dependent on each other.
4. In his overview of different definitions, Christian Pohl identifies the following five common characteristics for transdisciplinarity: it is problem-oriented, interdisciplinary, praxis-oriented, processual and participatory (Pohl, 2001). I restrict the definition here to interdisciplinarity and participation, because the other three features are neither easily definable, nor could they be said not to be part of normal disciplinary research. There is nothing in the definition of disciplines that would hinder disciplines from doing problem-oriented, praxis-oriented and processual research. Just think of engineering, anthropology or medical research.
5. The critique that transdisciplinarity is not new, but has always been here (Pestre, 2000), may be empirically correct, but it misunderstands the phenomenon. Transdiscipinarity may be not new at all, but only recently became visible as a strategy to describe certain research as legitimate ways of knowledge production. Before we had the very differentiated system of disciplines and their legitimating epistemologies, there was no need to define or even call for transdisciplinarity. The same holds true for most of the other hot terms in science policy talk, such as 'knowledge society' or 'mode 2'. We use them to describe the knowledge production *after* the full differentiation of disciplines.
6. The material was collected as part of my doctoral thesis (Guggenheim, 2005), which was part of the research project 'The production of socially robust knowledge', sponsored by the program 'Demain la Suisse' of the Swiss National Science Foundation.
7. Therefore, and for lack of space, I am not providing here a detailed background of the empirical material and the differences between the companies. However, it is important to note that there are big differences with respect to closeness to research, thematical orientation and size (three to 200 employees) between the different companies but also between different projects of a single company.
8. 'Environmental' issues are notoriously difficult to define and thus the category of environmental consultancies is a very loose one. The companies represented in this study were selected from the membership catalogue of the Swiss Association of environmental consultants (SVU-ASEP, 2001). I relied thus on the self-definition as environmental consultants. Their projects range from the building of waste-heat powered greenhouses over the construction of sustainability indicators to biodiversity cartographies and river renaturation. Some of the companies specialise in a single field, such as biodiversity or noise; others do not and constantly adapt to newly emerging fields, such as recently electromagnetic pollution or contaminated sites. The interviews were conducted with representatives from companies that reflect the spectrum of the whole field. The fieldwork, however, was conducted only in companies with a broad range of projects.
9. In the USA the boom of environmental consultancies happened earlier. In 1974 already over 1,000 environmental related companies and more than 300 "professional or occupational groups" existed (Nelkin, 1977: 81).
10. This is the typical organisational model for knowledge-intensive and project-based firms; see for example Hobday (2000).
11. For a definition of disciplines as markets with names that trade persons with degrees, see Turner (2000).
12. With regard to the typology of interdisciplinary research styles elaborated by Martin Lengwiler in this issue, most of the environmental consultancies could be classified as a mixture of heuristic and methodical interdisciplinarity. They all are highly organised but with different levels of cognitive coupling. The level of cognitive coupling is restricted by the often very broad palette of fields in which the companies work but it is is heightened by the strong role of field-independent methods such as cost-benefit analysis, integrated modeling or sustainability indicators.
13. The environmental consultancies are very similar in this respect to the Omicron institute representative of the heuristic style of interdisciplinarity as elaborated in Martin Lengwiler's article (this issue, pp. 423–434).
14. For a general discussion of the 'audit society' see Power (1997: 2307)], for external evaluation in the academy see the articles in Strathern (2000: 1652), for the case of medicine see Van Herk (2001: 2103).
15. For interpretations of QMS as control regimes in a Foucauldian spirit see Bröckling (2000) and Townley (1998). However, such an interpretation of QMS is too narrow and empirically QMS do not only enhance the control of the management over the staff but also give the staff new freedom (Knights and McCabe, 2000). Another interesting ethnographical analysis of how QMS works can be found in Cochoy *et al* (1998). For a case study of the introduction of ISO 14 000 see Reverdy (2000).
16. One of the companies later loosened this restriction, imposing the duty on me to decide which passages I could use without harming the company's interest. It would be worse,

they argued, if dismissed staff took the QMS out of the company, than if I published parts of it under the obligation not to betray their trust.

17. In management-consulting firms, timesheets exist but overtime is not calculated. Thus, if projects take longer, the employees are supposed to work overtime without reflecting it on the timesheets and without being paid for their overtime (personal communication with a former employee of a big consulting firm). It is thus not timesheets per se, but rather their special usage that creates the described problems. In new media companies on the other hand, it seems that timesheets are used less often, although such companies have a similar structure to environmental consultancies (Girard and Stark, 2002).
18. For a more detailed ethnographic study on the working of timesheets see Brown (2001).
19. In the field of environmental expertise, salaries tend to be low compared to other consultancy work. A company can charge around €1,000 per day, whereas management consultancies charge more than double this sum. This is astonishing insofar as the work of environmental consultancies is rather less standardised than the work of management consultants. In an interesting article Kipping has shown how some management consultancies were losing ground because the distribution of employees on the different hierarchical levels did not match the projects anymore. McKinsey lost to the IT-consultants because McKinsey had too many senior consultants, who were too expensive to do the new IT projects (Kipping, 2002).
20. The preference for all-rounders is a feature of multi-thematic companies only. Monothematic companies do not have this problem.
21. The scientists on the supervisory boards are always professors and not lecturers or assistants. The professors are on the supervisory boards because they have to demonstrate the credibility of the project to the public. However, the public cannot judge the work; thus it is the title of the professors that secures credibility.
22. Note here that universities could do the same projects and then there would be less stress on delivery of products. Although it is difficult to show empirically, it seems that the dependency of supervisory boards makes it more difficult for companies to behave like universities and stress the originality and quality of results over their delivery. An analysis of the different ways of relating to certain values of science in tenders of universities and consultancies can be found in Breslau (1997).
23. As Maasen and Lieven (this issue of *Science and Public Policy*, pp. 399-410) show, in transdisciplinary university-based projects a similar process is happening: the projects are aiming at do-ables, small portions of results that are delivered in piecemeal fashion. Obviously the time structure of university science is following more and more the same path of publishing results when projects are 'finished' rather then when new results are ready. Strategic publishing has become an art in itself. However, it is linked to individual reputation and careers, not to external supervision.
24. One could write a whole ethnography of the field of environmental consulting by following the different and usually polemical uses of the word 'practical', as opposed to 'theoretical'. It is very important for the credibility of the companies to show that they really do something practical, that they really solve a problem, etc, which is usually opposed to meaningless, theoretical, abstract work that is supposedly done in universities and bureaucracies. It is very much at the heart of the self-fashioning of the companies to be useful, efficient and timely; in short, practical.

References

Abbott, Andrew 1988. *The System of Professions: An Essay on the Division of Expert Labor*. Chicago: University of Chicago Press.

Abbott, Andrew 2001. *Chaos of Disciplines*. Chicago: University of Chicago Press.

Bourdieu, Pierre 1975. The specificity of the scientific field and the social conditions of the progress of reason. *Social Science Information/Information sur les Sciences Sociales*, **14**, 19–47.

Breslau, Daniel 1997. Contract shop epistemology: credibility and problem construction in applied social science. *Social Studies of Science*, **27**(3), 363–394.

Bröckling, Ulrich 2000. Totale Mobilmachung. Menschenführung im Qualitäts- und Selbstmanagement. In *Gouvernementalität der Gegenwart. Studien zur Ökonomisierung des Sozialen*, eds. Ulrich Bröckling, Susanne Krasmann *et al*, pp. 131–167. Frankfurt a. M.: Suhrkamp.

Brown, Barry 2001. Representing time. the humble timesheet as a representation and some details of its completion and use. *Ethnographic Studies*, **6**, 13–20.

Cochoy, Franck, Jean-Pierre Garel and Gilbert de Terssac 1998. Comment l'Ecrit Travaille l'Organisation: Le Cas des Normes ISO 9000. *Revue Francaise de Sociologie*, **39**(4), 673–699.

Gibbons, Michael, Camille Limoges, Martin Trow *et al* 1994. *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London: Thousand Oaks; and New Delhi: Sage.

Girard, Monique and David Stark 2002. Distributing intelligence and organizing diversity in new media projects. *Environment and Planning A*, **34**(11), 1927–1949.

Guggenheim, Michael 2005. *Organisierte Umwelt. Intersystemische Wissensproduktion in Umweltdienstleistungsfirmen*. Bielefeld, Transcript.

Hirschauer, Stefan 2004. Peer Review auf dem Prüfstand. Zum Soziologiedefizit der Wissenschaftsevaluation. *Zeitschrift für Soziologie*, **33**, 62–83.

Hobday, Mike 2000. The project-based organisation: an ideal form for managing complex products and systems? *Research Policy*, **29**(7-8), 871–893.

Kipping, Matthias 2002. Trapped in their wave: the evolution of management consultancies. In *Critical Consulting: New Perspectives on the Management Advice Industry*, eds. Timothy Clark and Robin Fincham, pp. 28–49. Oxford: Blackwell.

Klein, Julie Thompson, Walter Grossenbacher-Mansuy and Rudolf Häberli eds. 2001. *Transdisciplinarity: Joint Problem Solving among Science, Technology, and Society. An Effective Way for Managing Complexity*. Basel: Birkhäuser.

Knights, David and Darren McCabe 2000. "Ain't misbehavin'"? Opportunities for resistance under new forms of "quality" management. *Sociology*, **34**(3), 421–436.

Knorr Cetina, Karin 1999. *Epistemic Cultures: How the Sciences Make Knowledge*. Cambridge: Harvard University Press.

Latour, Bruno 1993. *We Have Never Been Modern*. Cambridge: Harvard University Press.

Mendel, Peter James 2002. *Global Models of Organizations: International Management Standards, Reforms, and Movements*. Dissertation. Stanford: Stanford University Press.

Merton, Robert King 1973. The normative structure of science. In *The Sociology of Science: Theoretical and Empirical Investigations*, ed. Robert King Merton, pp. 267–278. Chicago: University of Chicago Press.

Nelkin, Dorothy 1977. Scientists and professional responsibility: the experience of American ecologists. *Social Studies of Science*, **7**(1), 75–95.

Pestre, Dominique 2000. The production of knowledge between academies and markets: a historical reading of the book "The New Production of Knowledge". *Science, Technology and Society*, **5**(2), 169–181.

Pohl, Christian 2001. How to bridge between natural and social sciences? An analysis of three approaches to transdisciplinarity from the Swiss and German field of environmental research. *Natures, Sciences, Sociétés*, **9**(3), 37–46.

Power, Michael 1997. *The Audit Society: Rituals of Verification*. Oxford: Oxford University Press.

Reverdy, Thomas 2000. Les Formats de la Gestion des Rejets Industriels: Instrumentation de la Coordination et Enrolement dans une Gestion Transversale. *Sociologie du Travail*, **42**(2), 225–243.

Stichweh, Rudolf 1994. Professionen und Disziplinen: Formen der Differenzierung zweier Systeme beruflichen Handelns in modernen Gesellschaften. In *Wissenschaft, Universität, Professionen*, ed. Rudolf Stichweh, pp. 278–336. Frankfurt a. M.: Suhrkamp.

Strathern, Marilyn ed. 2000. *Audit Cultures: Anthropological Studies in Accountability, Ethics and the Academy*. London: Routledge.

SVU-ASEP 2001. *Dienstleistungsverzeichnis der Beratungsfirmen im Umweltbereich*. Bern.

Townley, Barbara 1998. Beyond good and evil: depth and division in the management of human resources. In *Foucault,*

Management and Organization Theory: From Panopticon to Technologies of the Self, eds. Alan McKinlay and Ken Starkey, pp. 191–210. London: Sage.

Turner, Stephen 2000. What are disciplines? And how is interdisciplinarity different? In *Practising Interdisciplinarity*, eds. Peter Weingart and Nico Stehr, pp. 46–65. Toronto: University of Toronto Press.

Van Herk, R, N S Klazinga, R M J Schepers *et al* 2001. Medical audit: threat or opportunity for the medical profession. A comparative study of medical audit among medical specialists in general hospitals in the Netherlands and England, 1970–1999. *Social Science and Medicine*, **53**(12), 1721–1732.

Weber, Max 1988. *Gesammelte Aufsätze zur Wissenschaftslehre*. Tübingen: Mohr.

Weingart, Peter 1987. Interdisziplinarität als List der Institution, In *Interdisziplinarität. Praxis – Herausforderung – Ideologie*, ed. Jürgen Kocka, pp. 159–166. Frankfurt a. M.: Suhrkamp.